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ABSTRACT

Attention has been focused on critical shortages of information technology professionals. These shortages have begun to affect the ability of state and local governments to perform core operations, meet new agency program needs and support the development of new enterprise-wide capacities. The shortages are not expected to disappear any time soon. Absent proactive measures, government agencies can expect to experience more severe effects as the information technology (IT) workplace reaches retirement age. (The current average age of IT professionals in state service is estimated at 47 years.) Given these dynamics, organizations are currently relying on one or more of three strategies to overcome shortages: (1) outsourcing; (2) use of contracted services; and (3) enhanced attempts at staff recruitment and retention. Each one of these strategies involves cost and risks. Without an overall plan for management and a strategic investment of IT resources tied to a plan for the effective use of information to support new business and enterprise-wide needs, responses to the staffing shortage are likely to be disjointed, ineffective and sub-optimal. Success in achieving the goal of adequately transforming the state and local government workforce in the face of a developing information economy could very well mark the success or failure of government's overall transition to a more efficient, effective and citizen-friendly enterprise. (Author/AEF)

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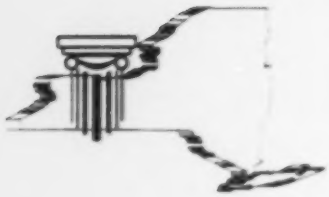

NYSFIRM Government Information Focus

The Information Technology Workforce Crisis: Planning for the Next Environment

Terrence A. Maxwell

ED 420 312

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Executive Summary

Recently, attention has been focused on critical shortages of information technology professionals. These shortages have begun to affect the ability of state and local governments to perform core operations, meet new agency program needs and support the development of new enterprise-wide capacities. Moreover, the shortages are not expected to disappear any time soon. Absent proactive measures, government agencies can expect to experience more severe effects as the information technology (IT) workforce reaches retirement age. (The current average age of IT professionals in state service is estimated at 47 years).

Given these dynamics, organizations are currently relying on one or more of three strategies to overcome shortages: Outsourcing, use of contracted services, and enhanced attempts at staff recruitment and retention. However, each one of these strategies involves costs and risks. Without an overall plan for management and a strategic investment of IT resources tied to a plan for the effective use of information to support new business and enterprise-wide needs, responses to the staffing shortage are likely to be disjointed, ineffective and sub-optimal.

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Technology Workforce Shortages Become Critical

Several recent reports have highlighted the critical shortages facing public and private sector employers seeking staff in critical information technology areas. Industry experts indicate that these shortages are expected to impact public sector organizations more severely, because of lack of flexibility with respect to pay and benefit packages. A short review of some recent studies and news reports indicates the seriousness of the current situation.

- In a study released in the beginning of January, Virginia Tech learned that **there are currently 346,000 positions for computer programmers, system analysts, and information engineers vacant in the United States.** This represents 10% of the total information technology positions in companies of more than 100 employees. The findings were based on a telephone survey of 532 technology companies.

- The U.S. Bureau of Labor Statistics reports that **the United States will require 1.3 million new information technology workers between 1996 and 2006**. The Bureau defines information technology jobs as including computer science, engineering, systems analysis and computer programming.

- *Computerworld*, which tracks information technology employment trends, indicated in its January 5th, 1998 edition that **more than half the 270 IT managers contacted hoped to increase IT staff by at least 10% in 1998**. In the Northeast, more than 25% of respondents intended to increase jobs by more than 20% this year.

- **Networking skills are in greatest demand**, particularly in the areas of TCP/IP, Ethernet, network management, and Novell Netware. **Oracle, C and C++, Windows NT and Cobol skills are also especially valued**.

- **Valuable skills translate into higher salaries.** Buck Consultants and Meta Group indicate the average salary of a Web engineer in New York City is currently $81,623, while the typical Webmaster earns $86,319 and Web programmer $75,417. SAP contractors earn a salary premium of 40% over normal contract rates, Peoplesoft experts command a 33% premium, while contractors with Oracle skills earn 23% above regular rates.

An informal survey by the Forum of local college placement officers underscores the current situation. Placement officers report that college graduates in IT related areas with little or no experience are being hired

quickly for significant salaries. The average salary range reported for graduating students was $35,000 to $50,000, in addition to other incentives such as sign-on bonuses, automobiles and stock options.

How will the shortages affect the operations of state and local agencies in the coming years? In the following pages, we will discuss the reasons for the current situation, the effects of shortages on state and local governments, some recent responses to the problem, and the hard choices facing government agencies in the coming years as a result of this trend.

Why Did the Shortages Occur?

While there is general agreement that shortages exist, there seems to be little agreement on why they occurred. The biggest focus currently among members of the media is that the job of information technology professional is seen as too "nerdish," and therefore not exciting for young people looking for careers. Therefore, the argument goes, we should somehow market information management as exciting and "sexy."

While superficially attractive, this argument ignores several other dynamics. They include:

Until recently, IT salaries have not kept pace with other professional salaries in organizations. *Computerworld* magazine, which has tracked IT compensation rates for a decade, has shown salary growth in IT professions to be well below that of other business areas. They attribute this phenomenon to the view, until recently, of information management as a "back office" function, not as a critical requirement for organizational health and growth. This perception also led to cutbacks in IT positions earlier in the decade, leading to a slowdown in demand for information professionals.

The Year 2000 problem has led to an increased demand for information professionals.

Businesses are spending significantly more on IT investments than previously. The Gartner Group predicts that North American companies will spend 9% of their revenue on IT next year, as opposed to 5% in previous years.

There is a mismatch between higher educational programs, which typically take 4 years, and the technology lifecycle, in which new technologies and skills are required on a 2 year cycle. This also means that the skills of a newly graduated IT professional will be severely degraded within 2 years of graduation, requiring constant retraining. In addition, the

integration of computer functions will require development of a set of skills, rather than one area of expertise.

Effects on the Current Workforce

The effects of the current IT shortage are significant, both from the perspective of IT professionals and the organizations for whom they work.

From the professionals' perspective, the current situation represents a potential opportunity for higher pay, more interesting work, and new challenges and experiences. Many professionals have already taken advantage of this opportunity, in sharp contrast to the situations many faced less than a decade ago, when many IT staff were among those let go by organizations engaged in downsizing and cost cutting.

For many professionals, this opportunity is manifested by less reliance on traditional organizations, and more on self-employment and contracting. The Gartner Group reports that between 40% and 50% of programmers and other IT professionals working in North America and Europe are currently self-employed contractors, highlighting both the potential lucrativeness of contracting and the fact that internal IT organizations are not well-staffed to meet the needs of their businesses.

For organizations, the situation is just the reverse. High turnover (an average of 15% to 20% a year in information management jobs according to the Gartner Group) translates into significant hard and soft costs for organizations, including:

> **Hard costs:** advertising, temporary replacements, training costs for new employees, lost productivity from former employees and interview costs.
>
> **Soft costs:** loss of institutional memory and knowledge of systems and applications, drag on current employees who must orient new staff, loss of team cohesion, and loss of project momentum.

Of all the above costs, the loss of project momentum and the need, in some cases, to postpone or cancel new initiatives because of a lack of adequate staff is perhaps the most serious impact. This is especially true in areas where significant programmatic changes are contemplated or underway, but where the information systems necessary to implement or support the new initiatives can not keep pace. This can lead to a situation where programmatic changes and improvements are held hostage to human resource constraints.

Current New York State Government Trends

New York State and Local government agencies are struggling with the effects of the IT shortage. An informal survey of state agencies undertaken by the Forum has identified several trends, including:

- **Loss of key staff to private industry**, particularly senior staff with significant organizational and business experience and younger staff with particular skill sets that are attractive to business.

- **Recruitment problems for core competencies**. The Grade 18 programmer list in particular has been difficult to recruit from. Recent advertisements and focus by the press on this issue has led in recent weeks to an upsurge in applications from 83 in the beginning of January to 340 for the currently scheduled exam. It will be important to monitor long term trends in this regard to see if continuous *active* recruitment can help ease the government IT shortage.

- **Mismatches between needs and civil service structures**. In general, agency needs fall into two major categories (technical and business support) consistent with the directions outlined in the previous Forum/ICEDP white paper *A Proposed Model for Information Resource Management Recruitment, Title Structure, and Selection*. However, there is no clear differentiation between the categories in the current civil service structure, leading to inappropriate placement of individuals on particular lists and confusion about advancement opportunities. In addition, the new model for technical staffing needs, where an individual will have a "toolbox" of competencies which may cross traditional titles, has resulted in situations where employees with broad general skills cannot be easily fit into a particular classification structure, lose advancement opportunities, and are lured away from state employment.

- **Recent early retirement options have drained away competencies in key areas, such as COBOL programming**, for which there is a great need in industry, particularly with Year 2000 fixes.

- **Significant transfer of staff between state and local agencies.** In general, professional staff with highly sought-after skills are transferring from smaller agencies to larger organizations, where there are more opportunities for advancement and participation in interesting projects.

In general, the Civil Service Department estimates that the average age of computer professionals in state employ is currently 47 years. This is a dramatic indication of our current inability to refresh the IT workforce with new talent who possess new skills in a rapidly changing environment. It also foreshadows the potential for serious problems in the future, as the current cohort of senior IT managers and technical experts retire.

The impacts of staff turnovers and shortages in government are similar to those noted above for the industry in general. However, it is important to note that there are currently critical business and information infrastructure projects underway in New York State government that will require large numbers of information staff to implement and manage during the coming years. These include redesign of the public medical system to support managed care, installation of new statewide payroll and personnel systems, reform of the welfare system to support work and integration of services across agencies, the development of a statewide intranet (the NYT), data center consolidation, general Year 2000 fixes, and a massive influx of technology-enabled learning in the state's secondary schools, colleges and universities. Shortages in core skills necessary to undertake these critical projects and loss of key technical and professional staff may lead to delays in implementation, increased labor and contracting costs, and service inefficiencies which result in cost escalation and revenue loss.

Responses

Businesses and government are racing to respond to the professional IT shortage. The Federal government has announced a grant program for universities to support more computer science slots for students, a program some observers feel should be expanded to include areas closely related to computer science, such as business and public administration schools specializing in information management, and library and information science schools that train students in the use and classification of information.

Private corporations are going to great lengths to recruit new IT staff, according to a recent *Computerworld* article (Jan. 5, 1998). Among the tactics being employed are pay and incentive bonuses for new hires, job fairs, referral bonuses for current employees who recruit IT professionals, continuous advertising in print and on the World Wide Web, the use of recruiters and headhunters, international recruitment of IT professionals, and the establishment of programming and support operations in countries like India with highly educated staff and low salary levels. In addition, the timeframe for proffering offers to perspective employees has dropped dramatically. Previously, candidates were given several interviews before receiving offers: Many are now often being offered jobs after a single interview.

As noted above, contracted services are also regularly used. This option, however, requires more internal management skills and expertise, particularly as it relates to the integration of contracted and core staff and the smooth completion of projects in an atmosphere of high staff and contractor turnover. This option is also potentially dangerous for governmental organizations, in that funds for contracting are often cut during periods of shortage, are contingent on outside sources such as Federal grants, and lead to little organizational continuity on projects.

Outsourcing of IT functions is also a common option, but the current global shortage of professionals is also affecting firms who provide outsourcing services, making the outsourcing option risky. State and local agencies who use private firms to perform some services are reporting a scarcity of vendor staff with the experience and knowledge to provide quality service. Outsourcing, like contracting, also requires that the organization have managers with expertise in negotiation and contract monitoring, to ensure the organization gets value from any outsourcing arrangements.

Among the more creative solutions noted are the establishment by private corporations of computer labs on college campuses, which provide a means for direct recruitment of talented students trained in skills of particular interest to the corporation. Another key trend is the establishment of closer partnerships between IT management and human resources staff, to ensure that prospective staff are not lost because of bureaucratic disputes and delays.

To date, there have been few proactive responses by state and local government agencies to the crisis. However, the recently announced intentions by Civil Service Commissioner Sinnott to support the hiring of new IT staff signals an awareness of the deeper nature of the problem. Another important step toward addressing the problem was undertaken this past summer, where a subcommittee of the Governor's Task Force on Information Resource Management (now the Office for Technology) chaired by Paul Puccio, Executive Deputy Commissioner of OASAS, made a series of recommendations to deal with the chronic problems of IT recruitment in New York State. Among the recommendations of the subcommittee were:

- Mandatory executive level training for top managers to educate program executives in the importance of information management as a strategic asset in government and provide them with the skills to effectively manage information;

- Changes in organizational structures to recognize the importance of IT leaders as meaningful actors in the core business team of agencies;

- Development of a core "line of succession" for top IT managers in organizations, to ensure continuity;

- A targeted and strategic investment in training both at the agency and enterprise level to develop expert technical and customer support teams; and

- A substantive review and refinement of the State's recruitment, selection and retention practices to reflect the shifts in workforce needs and structures.

The above recommendations were delivered to Governor Pataki's executive staff. They have been followed by meetings under the aegis of the Office for Technology to review and begin implementation of several of the subcommittee's ideas.

Other state governments have also begun to react to the crisis. For instance, California has struggled with the shortage of IT professionals for some time, due to the demand for computer professionals by high tech industry. In response, they have partnered with the University of California at Davis and the Project Management Institute to develop a project management training and certification course for state IT professionals. This program serves two primary purposes. It provides a training and career advancement opportunity for state staff, and deals with a problem which has confronted state government for some time—the failure of high profile computer systems costing millions of dollars due to weaknesses in project management.

The Future

Are current activities to meet the information technology shortages appropriate and sufficient? This is a hard question to answer, given the uncertain employment and technical situations New York governments are experiencing. However, we can begin to see directions we need to take by considering the following:

The demand for IT enabled solutions to the problems of delivery of government services is likely to increase rather than decrease. This is because the need to improve efficiency will continue to predominate as pressures to cut taxes and improve services increase, in order to make New York more competitive in attracting new businesses, maintaining current businesses and improving the quality of life. Another key driver in this dynamic will be the increased sophistication and demand by citizens, who experience IT-enabled improvements in the private sector and expect similar improvement in public sector organizations.

The Year 2000 problem will increase the shortage of skilled IT professionals through the Year 2000. In addition, publicized failures of large systems in the coming months will highlight the importance of effective information management as central to organizational functioning, and probably lead to new application development and significant system changes well past 2000.

The technical skills gap in particular areas will likely expand during the next five years. This will be especially true in the area of networking and data management, since organizations are rapidly expanding their networking capacities beyond the traditional "stovepipe" program boundaries, and will need to connect to more partners in order to provide integrated service and improved delivery of services in areas like human services, criminal justice, and general government. The emphasis on expanding the pool of college graduates will likely have only a temporary impact, since skills will need to be constantly upgraded even after graduation.

We can expect to experience an increased reliance on "off-the-shelf" software packages in core administrative areas during the next five years. Standard financial, payroll, human resource management, office automation and document management application packages will predominate, since they will require less in-house programming staff to develop and less time to bring on-line. **However, the use of "off-the-shelf" software requires a new skill, which we call "business system integration."** This involves integrating the traditional business processes of governmental organizations with the new processes embedded in pre-designed software in a way that optimizes efficiencies and minimizes the development of customized modules.

Without a new influx of managers, we can expect to see a shortage of government IT management skills in the coming decade. Current government IT management staff are aging. Many technology leaders in New York State will be reaching retirement age within the next ten years. Absent proactive responses, this skill shortage will be in direct operations management and in project and contractor management expertise. The degree of impact will be determined by the IT management profile of individual agencies and the government enterprise as a whole.

We can expect consolidation of human resources in certain IT areas. This is particularly apparent in the area of management and operation of large data centers, where New York has embarked on consolidation of this asset. There are also trends toward application development consolidation, particularly in the human services arena (where policy decisions are driving program delivery toward integration), and in networking backbone management, where the NYT intranet is expected to provide a common network backbone for state and local government agencies.

Outsourcing and the extensive use of contractors will continue to be facts of life in the coming years. However, the degree to which these options are used will be determined by the degree to which information and information related technologies are considered key strategic assets to be directly managed by government organizations, the track record of outsourcing contracts in the near term (for which there is currently much concern due to the effect of staff shortages on vendors and customers), and the capacity of government organizations to monitor and manage large vendor and individual contractor relations.

In addition, the outsourcing and contracting models are potentially far more costly than the traditional internal staffing model, both with respect to hard dollar costs in the current overheated employment environment, and soft costs related to the disruption to the normal operations of government agencies. Government agencies will need to carefully consider both direct *and* hidden costs when making staffing decisions in the coming years.

Hard Choices

Given these constraints, state and local governments are beginning to see the need for new ways of organizing the IT function in government. In fact, this shift in organizational structures will not be unique to government. The Gartner Group predicts, for instance, that only 25% of organizations will return to pre-crisis structures as the IT hiring crisis abates, while 35% of organizations will outsource core information functions, and 40% of organizations will undertake a substantial redesign of their IT organizations in response both to shortages and new information management requirements.

In New York State governments we can expect the development of a three-tiered model for IT organizations, and an accompanying three-tiered requirement for IT staffing in the coming years. This is illustrated in the following diagram.

Enterprise-wide functions	
(Data Center operations, Enterprise Network Backbones, Electronic Commerce oversight and support, Core Data management, procurement, enterprise-wide application development and support)	
Technical skills — Networking, data center operations, enterprise server support, directory services, EDI, electronic signatures and encryption, data modeling and data flow analysis, information security, programming	Business skills — Customer (agency) relations, project management, vendor management, process re-engineering and business systems integration
Cross Agency Functions	
(Cross agency application development and system integration)	
Technical skills — Programming, database management, business query tools development	Business skills — Process re-engineering, business systems integration, customer relations, project management, vendor management
Agency Functions	
(Unique agency program support and integration to cross-agency and enterprise-wide systems)	
Technical skills — Local Area and Wide Area Network management, programming, internal data management, legacy integration, business query tools support, local server and desktop asset management and support, e-mail, World Wide Web and other Internet-related tools support, information security	Business skills — Process re-engineering, business systems integration, customer relations (internal and with client organizations), project management, vendor management, archives and records administration

It is important to note that the above structure does not presume the exclusive use of outsourcing, contracted services, or in-house expertise to properly manage the information assets of government organizations. In fact, we expect that some combination of outsourcing, contracting and in-house development and support will be required at all three levels of the structure. However, agencies and the state as a whole will need to make these strategic decisions in concert with decisions on IT hiring, retention and training. The importance of this is highlighted below.

Outsourcing

Outsourcing decisions should not be made until a thorough review of user requirements is undertaken, and a strategic decision is made by top management that the operation to be outsourced is ***not critical*** to the core operations of the organization and can be safely contracted to an outside vendor. This decision making process should not occur until leadership is thoroughly trained in information management, consistent with the recommendations of the Subcommittee on Workforce Issues.

In areas where the state as a whole and individual agencies determine outsourcing is the appropriate response to our needs, a strategic investment in providing for and training adequate numbers of project and vendor relationship managers must occur. In addition, provision must be made to ensure for "user advocacy" mechanisms, so that the needs of the end users are paramount in negotiations around contract provisions, service level agreements, support requirements, and outsourcing re-procurements.

Contracting

Unlike outsourcing, a decision to hire large numbers of contractors to supplement internal expertise does not involve a decision by top leadership to put the information assets in the hands of outside vendors. It does, however, require the development of particular management skills. By acting as "general contractor," the agency or agencies must have trained managers who can hire, negotiate with, manage and on occasion fire contractors, integrate the activities of independent contractors with internal staff, and manage the inevitable human conflicts between higher paid contracted staff and permanent state and local employees. A recent article by Susan Herrmann in the March, 1998 *Open Forum* highlights some of these challenges.

In addition, state and local employees must be sufficiently trained to take best advantage of opportunities to learn the skills possessed by external contractors, in order to maintain continuity in an environment of high contractor turnover. This is also critical for ongoing maintenance of programs

and facilities after a project is implemented, when the system has been turned over to government staff to operate.

A variation of the contracting model involves state and local government agencies subcontracting with one another for particular skills. Agencies who wish to follow this entrepreneurial model must have sufficient internal capacity to support outsourcing their services, as well as contract negotiation and management expertise to adequately support their customers' needs.

In-House Staffing Recruitment, Maintenance and Development

Relying primarily on in-house staffing for information management requires the greatest commitment to staff, but provides for the most stable organizational arrangement. However, developing and maintaining a highly skilled and motivated workforce in an environment with significant outside pressures to hire away current staff and compete for potential staff requires a significant departure from traditional government human resource practices, which have promoted stability over variety, single skill achievement and maintenance over multiple skill acquisition and training, and cross-organization and cross-staff equity over individual empowerment and recognition.

Of particular concern is the current Civil Service structure. An earlier Forum/ICEDP white paper made several recommendations in this regard, including:

- Development of two title structures, one for technical staff and another for business area information support;
- Modification of testing procedures to provide for more flexibility and applicability to particular job needs;
- Provision for performance bonuses for exceptional service; and
- Flexible recruitment processes including campus recruitment, internships, certified college curricula, executive search firms, interagency rotations and a centralized candidate database.

In addition, the report called for more emphasis on training and technology implementation issues, and a concerted effort to address practices which make the State and Local governments noncompetitive with respect to hiring and retention.

These recommendations closely match the basic requirements of effective employment practices defined by Abraham Maslow's "hierarchy of needs." This structure, which is well known in both the private and public sector, argues for the following requirements for staff recruitment and retention.

Shelter & Environment	• Adequate and safe work facilities • Adequate pay scales • Decent benefits, such as time off, medical plans, and child care facilities
Job Security	• Articulated plan for the organization's use of IT staff and resources in the future
Community, Identity and Equity	• A vision of how the organization should work, and IT's role in the development of that vision • The establishment and maintenance of work teams, both internal and cross-organizational • Employee involvement and open information sharing • Performance feedback to the employee • A sense of job significance, coupled with some level of autonomy and responsibility for the outcome
Recognition	• Bonuses and/or time off for good performance • Flexible work schedules and use of tools like telecommuting • Continual training, targeted to project and organizational needs
Challenges	• Job rotation to increase skills • New project responsibilities • New skill development

The extent to which organizations can implement the actions outlined above will determine their success in hiring and retaining key information technology and other staff. Meeting this challenge in the difficult environment currently faced by state and local government agencies will require:

- An articulated vision of where we want to go both as an enterprise and as individual agencies;
- Changes to old practices and ways of doing business (such as modifications to Civil Service hiring and classification practices and changes in training opportunities similar to those articulated in the Forum/ICEDP white paper and the Task Force Workforce Subcommittee report);
- Retraining of current staff in related fields (e.g. clerical workers and middle level financial and program managers); and
- Significant ongoing resources to support the new structures.

In general, our success in achieving the goal of adequately transforming the state and local government workforce in the face of a developing information economy could very well mark the success or failure of government's overall transition to a more efficient, effective and citizen-friendly enterprise.

NYSFIRM

The New York State Forum for Information Resource Management (NYSFIRM) is a network of public officials and State government organizations concerned with information management policy and technology.

Information is a vital resource for New York State. Agencies of State government have widely adopted information technologies to improve their abilities to meet their responsibilities. These technologies, the information they process, and the people who use and manage them are essential components of modern government. Together they support a wide variety of public services, contribute to economic health and development, help to manage the state's physical infrastructure and the natural environment, and foster educational and cultural development. Public managers in New York State have become increasingly aware of a need to articulate information policies and to improve the management of information resources which support state operations. A mechanism is clearly needed to support an ongoing exchange of professional and managerial experiences, to coordinate efforts involving issues that are common or transcend the ability of a single organization, and to facilitate useful sharing of the State's technological, human and information resources.

It is the mission of the New York State Forum for Information Resource Management to promote policies and practices for effective use and management of information resources in New York State Government.